

**SYNTHETIC MINOR APPLICATION EVALUATION REPORT  
INTERNATIONAL POWER TECHNOLOGY  
APPLICATION 18196, PLANT 7265  
Amended November 2003**

**BACKGROUND:**

International Power Technology has chosen to apply for a Synthetic Minor Operating Permit (SMOP) to comply with the Title V permitting requirements of the Federal Clean Air Act. The Title V permitting requirements were implemented as a result of the 1990 revisions to the Federal Clean Air Act.

The facility is a small cogeneration facility with a 54 MMbtu/hr turbine and a 40 MMbtu/hr duct burner. Using general emission factors, the facility would not be expected to exceed the Title V thresholds, but on 9-15-95, a source test performed by a District source test team showed that the facility had unusually high CO emissions.

The owner/operator stated that the high CO emissions were due to holes in the steam generator tubing, would be repaired, and would not be a recurring problem. However, since the facility had no ongoing CO monitoring to prevent such problems, the potential to emit (PTE) for CO was considered to have exceeded the 100 ton/yr Title V threshold.

The facility originally submitted applications #29148 and #29559 in 1983. The facility was subject to BACT for NO<sub>x</sub>. At the time, only the following four limits were imposed according to District policy at the time:

- 42 ppm NO<sub>x</sub> @ 15% oxygen, dry basis for the turbine
- 84 ppm NO<sub>x</sub> @ 3% oxygen, dry basis for the duct burner
- Natural gas firing for the duct burner
- Fuel oil firing at the turbine only during testing and natural gas curtailment

There are various heat input rates in the applications, depending on the units (MMbtu/hr (LHV), pounds of fuel) and different vendor statements, so it is unclear what the capacity of the facility was when it was built.

However, the facility did submit guaranteed hourly rates for hydrocarbons and CO, and concentrations for NO<sub>x</sub>. These rates will form the basis for this synthetic minor permit.

The facility has also recently received a permit for a 675-hp standby generator that lost its exemption on May 17, 2000.

## **EMISSION LIMITS STRATEGY:**

To obtain a synthetic minor permit, a facility must have enforceable limits that keep the potential to emit below 95 tons per year of any regulated pollutant, below 9 tons per year of any single HAP, and below 23 tons per year of any combination of HAPs. These limits include permitted and unpermitted sources.

The facility had limits for NO<sub>x</sub> at the turbine and duct burner before applying for a synthetic minor permit. In particular, the turbine (S1) has a limit of 42 ppm @ 15% O<sub>2</sub>, and the duct burner (S2) has a limit of 84 ppm @ 3% O<sub>2</sub>. The facility had no CO limits.

If the facility complies with the NO<sub>x</sub> concentration limits, the facility will not exceed the Title V thresholds for NO<sub>x</sub>, as shown in the emission calculations below.

The facility will measure CO concentrations and estimate flow rates based on the F-factor method in EPA Method 19, Determination of Sulfur Dioxide Removal Efficiency and Particulate Matter, Sulfur Dioxide, and Nitrogen Oxides Emission Rates, on a monthly basis. This information will be used to estimate monthly and annual CO emission to ensure that the facility does not exceed the Title V threshold for CO.

The facility also has the potential to emit more than 95 tons per year SO<sub>2</sub> at the turbine. Limits will be placed on combustion of diesel fuel to limit the SO<sub>2</sub> PTE.

The potential to emit for the standby generator will be based on an estimate of maximum usage of 500 hours in accordance with the 9/6/95 memo from John Seitz of EPA entitled "Calculating Potential to Emit (PTE) for Emergency Generators."

## **EMISSION CALCULATIONS**

### Turbine NO<sub>x</sub> based on NO<sub>x</sub> concentration

The current stated capacity of the turbine in the District's database is 54 MMbtu/hr of natural gas. The NO<sub>x</sub> concentration is limited to 42 ppm @ 15% oxygen. This limit was imposed at the time of the original Application #29559 in 1983. The annual NO<sub>x</sub> mass emissions allowed by this limit are calculated below using the F-factor method in EPA Method 19:

To calculate the flowrate at 15% O<sub>2</sub>:

$$54 \text{ MMbtu/hr} \times 8710 \text{ dscf/MMbtu} \times (20.9/(20.9-15)) = 1,666,120 \text{ dscf/hr}$$

At 42 ppm, 69.97 scf NO<sub>x</sub>/hr is formed. To convert to pounds using the gas law:

$$\begin{aligned} \text{lb moles NO}_x/\text{hr} &= PV/RT = (1 \text{ atm}) \times (69.97 \text{ cf/hr}) / (0.7302 \text{ atm-cf/}^\circ\text{R-lbmol}) (528^\circ\text{R}) \\ &= 0.1815 \text{ lb mol NO}_x/\text{hr} \end{aligned}$$

$$0.1815 \text{ lb mol NOx/hr} \times 46 \text{ lb NOx/lb mol NOx} = 8.349 \text{ lb NOx/hr} = 36.56 \text{ ton NOx/yr}$$

#### Duct Burner NOx based on concentration

The duct burner is allowed to burn 40 MMbtu/hr of natural gas. The NOx concentration is limited to 84 ppm @ 3% oxygen. This limit was imposed at the time of the Application #29559 in 1983.

However, the duct burner limit was based on 0.1 lb NOx/MMbtu fuel burned in the duct burner. On this basis, the maximum NOx emissions should be:

$$40 \text{ MMbtu/hr} \times 0.1 \text{ lb NOx/MMbtu} \times 8760 \text{ hrs/yr} \times \text{ton}/2000 \text{ lb} = 17.52 \text{ ton NOx/yr}$$

#### Turbine and Duct Burner NOx based on concentration

The turbine and duct burner limits must be averaged to get a total limit. 84 ppm @ 3% O2 is equivalent to 28 ppm @ 15% O2.

$$84 \text{ ppm @ 3\% O}_2 \times ((20.9-3)/(20.9-15)) = 28 \text{ ppm @ 15\% O}_2$$

The total limit for both the duct burner and the turbine is:

$$\begin{aligned} & ((54 \text{ MMbtu} \times 42 \text{ ppm}) + (40 \text{ MMbtu} \times 28 \text{ ppm})) / (90 \text{ MMbtu}) \\ & = 36 \text{ ppm @ 15\% O}_2 \end{aligned}$$

In this case, the total NOx is:

$$94 \text{ MMbtu/hr} \times 8710 \text{ dscf/MMbtu} \times (20.9/(20.9-15)) = 2,900,282 \text{ dscf/hr}$$

At 36 ppm, 104.4 scf NOx/hr is formed. To convert to pounds using the gas law:

$$\begin{aligned} \text{lb moles NOx/hr} &= PV/RT = (1 \text{ atm}) \times (104.4 \text{ cf/hr}) / (0.7302 \text{ atm-cf/}^\circ\text{R-lbmol}) (528^\circ\text{R}) \\ &= 0.2708 \text{ lb mol NOx/hr} \end{aligned}$$

$$0.2708 \text{ lb mol NOx/hr} \times 46 \text{ lb NOx/lb mol NOx} = 12.46 \text{ lb NOx/hr} = 54.56 \text{ ton NOx/yr}$$

The hourly and monthly limit will be added to the permit. Since the facility only has a monthly measurement for the natural gas throughput, the monitoring will show compliance with the annual limit.

Since the turbine cannot operate without the duct burner, 36 ppmv @ 15% O2 is the resulting limit.

#### Turbine and Duct Burner CO

The original application stated that the maximum CO would be 5.92 lb/hr total or 25.92 ton/yr. The hourly and monthly limit will be added to the permit. Since the facility only

has a monthly measurement for the natural gas throughput, the monitoring will show compliance with the annual limit.

#### Turbine and Duct Burner HC

The original application stated that the maximum HC would be 2.41 lb/hr total or 10.56 ton/yr. The hourly and annual limit will be added to the permit.

#### Turbine and Duct Burner SO<sub>2</sub>

No estimates of SO<sub>2</sub> were provided in the application. However, using the PUC specification for natural gas and the limit for sulfur content for diesel fuel, it can be determined if the facility is major for SO<sub>2</sub>.

The Public Utilities Commission (PUC) sulfur standard is 5 grains sulfur per 100 standard cubic feet (scf) of natural gas. One pound contains 7000 grains (gr) of sulfur (S). Each scf of gas contains approximately 1050 btu. If the facility burns 94 MMbtu of gas per hour, it consumes 89,523 scf of gas per hour or 784.2 MMscf per year. The maximum amount of sulfur that could be burned per year is 5601 lb/yr or 2.8 tons per year. 2 pounds of SO<sub>2</sub> are generated for each pound of sulfur so 5.6 tons of SO<sub>2</sub> could be generated per year. The actual sulfur content of natural gas is generally about 0.2 grains per 100 scf, so the actual SO<sub>2</sub> emissions will be approximately 0.22 tons per year for combustion of natural gas.

Diesel fuel can be burned in the turbine during periods of natural gas curtailment. The limit in Regulation 9-1-304 for sulfur in diesel fuel is 0.5% by weight. Diesel fuel weighs 6.7 lb/gal and contains 140,000 btu/gal. If the turbine runs at 54 MMbtu, it can consume 386 gallons of diesel fuel per hour or 3,379,000 gallons per year, which is equivalent to 22,638,000 pounds diesel fuel per year. At 0.5% by weight, 113,191 pounds or 56 tons of sulfur could be burned. Again, 2 pounds of SO<sub>2</sub> are generated for each pound of sulfur so 113 tons of SO<sub>2</sub> could be generated per year.

If the turbine burns exclusively diesel fuel, the maximum SO<sub>2</sub> contribution from the duct burner, which only has a permit to burn natural gas, is 2.38 tons per year.

The NSR and BACT threshold for SO<sub>2</sub> in 1983 when the facility was permitted was 25 tons/year. Since the facility was not subject to these standards for any pollutant but NO<sub>x</sub>, the facility has an implicit limit for SO<sub>2</sub>. This limit will be made explicit by adding a limit for the sulfur in diesel fuel. The facility will be allowed to emit up to 22.5 tons per year SO<sub>2</sub> at this source if natural gas is curtailed to that extent. At 0.5% sulfur by weight, the following amount of diesel can be burned:

$$(22.5 \text{ tons SO}_2/\text{year}) (2000 \text{ lb/ton}) \times (1 \text{ lb S}/2 \text{ lb SO}_2) (\text{lb diesel fuel}/0.005 \text{ lb S})$$
$$\times (\text{gal diesel fuel}/6.7 \text{ lb diesel fuel}) = 670,000 \text{ gal diesel fuel/yr}$$

The facility will be allowed to burn more diesel fuel if the facility can show that the sulfur content is lower than 0.5% by weight.

670,000 gallons diesel fuel per year is equivalent to 1735 hours curtailment per year, which is highly unlikely. The actual SO<sub>2</sub> emissions from combustion of diesel fuel are likely to be much lower. In fact, no diesel fuel was burned at the turbine during 2001.

#### Turbine and Duct Burner Particulate

No estimates of particulate were provided in the permit. However, using the general emission factors from the District's database, it can be shown that the facility is not major for particulate.

##### Particulate for Turbine and Duct Burner combined

Natural Gas:

$$(94 \text{ MMbtu/hr}) \times (0.014 \text{ lb PM/MMbtu}) \times (8760 \text{ hr/yr}) \times (\text{ton}/2000 \text{ lb}) = 5.764 \text{ ton/yr}$$

As shown above, the maximum amount of diesel that can be burned in the turbine if natural gas is curtailed for an entire year is 3,379,000 gallons per year. The general factor for particulate emissions for turbines is 2 lb/thousand gallons. The emissions of particulate in this case are:

$$(3,379,000 \text{ gal/yr}) \times 0.002 \text{ lb/gal} = 6758 \text{ lb/yr or } 3.4 \text{ ton/yr}$$

and

$$(40 \text{ MMbtu/hr}) \times (0.014 \text{ lb PM/MMbtu}) \times (8760 \text{ hr/yr}) \times (\text{ton}/2000 \text{ lb}) = 2.452 \text{ ton/yr}$$

Total particulate in this case:

$$5.852 \text{ tons/yr}$$

The potential to emit for particulate is not significant.

#### HAPs

##### Turbine: natural gas

The highest HAP emission factor for natural gas fired turbines in Table 3.1-3 of AP-42, dated 4/00, is 0.00071 lb formaldehyde/MMbtu. Since the duct burner burns up to 54 MMbtu, the annual emissions of formaldehyde could be 336 lb/yr, much lower than the 10 ton/yr HAP Title V threshold.

##### Turbine: diesel fuel

The highest HAP emission factor for natural gas fired turbines in Table 3.1-3 of AP-42, dated 4/00, is 0.00028 lb formaldehyde/MMbtu. This emission factor is lower than the formaldehyde factor for natural gas, and therefore, burning diesel would not increase the HAP emissions.

##### Duct Burner:

The highest HAP emission factor for external combustion in Table 1.4-3 of AP-42, dated 7/98, is 1.8 lb hexane/MMscf. Since the duct burner burns up to 40 MMbtu/hr or 0.038 MMscf, the annual emissions of hexane could be 599 lb/yr, much lower than the 10 ton/yr HAP Title V threshold.

The potential to emit for HAPs from the turbine and duct burner is not significant.

#### Standby Generator

The facility has also recently permitted a 675-hp diesel-fueled standby generator. 500 hours of usage will be assumed, based on EPA guidance, as mentioned above. Following are the estimated emissions based on the engine manufacturer's (Cummins) emission factors:

	Emission Factors			
	g/hp-hr	g/hr	lb/hr	ton/yr
POC	0.19	128	0.283	0.07
NOX	10.00	6750	14.881	3.72
CO	4.00	2700	5.952	1.49
PM	0.15	101	0.223	0.06

The SO<sub>2</sub> calculations are based on the maximum sulfur content of the diesel fuel-0.5% by weight. The engine is capable of burning up to 31.9 gal/hr diesel fuel. Using the data above, the SO<sub>2</sub> emissions will be:

$$(31.9 \text{ gal/hr}) \times (500 \text{ hr/yr}) \times (6.7 \text{ lb/gal}) \times (0.005) \times (2 \text{ lb SO}_2/1 \text{ lb S}) \\ = 1068 \text{ lb SO}_2/\text{yr} = 0.53 \text{ ton/yr}$$

The HAPs calculations for the engine are based on AP-42 emission factors from Table 3.4-3 and the fuel usage. 31.9 gal diesel fuel/hr is equivalent to 4.466 MMbtu/hr.

	lb/mmbtu	lb/hr	ton/yr
Benzene	0.000776	0.00346562	0.000866404
Toluene	0.000281	0.00125495	0.000313737
Xylenes	0.000193	0.00086194	0.000215485
Formaldehyde	0.0000789	0.00035237	8.80919E-05
Acetaldehyde	0.0000252	0.00011254	2.81358E-05
Acrolein	0.00000788	3.5192E-05	8.79802E-06

Emissions of HAPs from the diesel engine are insignificant.

#### Total Criteria Pollutant Emissions

ton/yr

POC	10.63
NOX	32.67
CO	27.41
PM	5.19
SO2	25.53

#### **STATEMENT OF COMPLIANCE:**

This facility is in compliance with the necessary requirements in Regulation 2, Rule 6 to obtain a synthetic minor permit. The facility has voluntarily accepted federally enforceable permit conditions including emission limits that will keep the facility's potential to emit under 95 tons per year of any regulated air pollutant, 9 tons of any hazardous air pollutant, and 23 tons of any combination of hazardous air pollutants. To establish compliance, the facility will measure NOx and CO concentrations once per month and estimate monthly and annual mass emissions of NOx and CO using the concentration measurements and the monthly natural gas bill.

If the facility burns more than 670,000 gallons of diesel fuel in any consecutive 12-month period, the facility will obtain the sulfur content of the fuel by weight and estimate SO2 emissions from the combustion of diesel fuel.

The facility will also track the hours of operation for the diesel engine.

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Condition 493:

--- SYNTHETIC MINOR OPERATING PERMIT ---

International Power Technology  
San Carlos Boulevard  
San Jose, CA 95150  
Plant #7265

Condition 493, parts #1-#19 establish the permit terms that ensure this plant is classified as a Synthetic Minor Facility under District Regulation 2, Rule 6 - Major Facility Review and ensure it is not subject to the permitting requirements of Title V of the Federal Clean Air Act as amended in 1990 and 40 CFR Part 70. All applications submitted by the applicant and all modifications to the plant's equipment after issuance of the synthetic minor permit must be evaluated to ensure that the facility cannot exceed the synthetic minor general limits below, and that sufficient monitoring, recordkeeping, and reporting requirements are imposed to ensure enforceability of the limits.

Any revision to a condition establishing this plant's status as a Synthetic Minor Facility or any new permit term that would limit emissions of a new or modified source for the

purpose of maintaining the facility as a Synthetic Minor must undergo the procedures specified by Rule 2-6, Section 423.

The basis for the synthetic minor conditions is an emission limit for regulated air pollutants of less than 95 tons per year, an emission limit for a single hazardous air pollutant of less than 9 tons per year, and an emission limit for a combination of hazardous air pollutants of less than 23 tons per year.

This operating permit covers all sources existing at the facility as of permit issuance. The sources are listed below:

Sources:

S-1, Gas Turbine

S-2, Coen Duct Burner

S-3, Standby Emergency Generator, Cummins KTA19-G4, 675 Standby hp

1. The owner/operator shall ensure that oxides of nitrogen emissions from the gas turbine (S-1) do not exceed a level of 42 ppm @ 15% O<sub>2</sub> (dry basis) averaged over any 3-hour consecutive period. [BACT]
2. The owner/operator shall ensure that the NO<sub>x</sub> emissions from the Coen Duct Burner (S-2) do not exceed 84 ppm @ 3% O<sub>2</sub>, averaged over any 3-hour period. [BACT]
3. The owner/operator shall ensure that the NO<sub>x</sub> emissions from the gas turbine (S-1) and the Coen Duct Burner (S-2) combined do not exceed 36 ppm @ 3% O<sub>2</sub>, averaged over any 3-hour period. [BACT]
3. The owner/operator shall ensure that oxides of nitrogen emissions from the gas turbine (S-1) and Coen Duct Burner (S-2) combined shall not exceed 12.46 lb/hr (as NO<sub>2</sub>). [BACT]
4. The owner/operator shall ensure that oxides of nitrogen emissions from the gas turbine (S-1) and Coen Duct Burner (S-2) combined shall not exceed 9270 lb/month (as NO<sub>2</sub>). [BACT]
5. The owner/operator shall ensure that the combined emissions of precursor organic compounds from the gas turbine (S-1) and duct burner (S-2) do not exceed 2.41 lb/hr. [BAAQMD Regulation 2-1-234.1]
6. The owner/operator shall ensure that the combined emissions of carbon monoxide from the gas turbine (S-1) and duct burner (S-2) do not exceed 4405 lb/month. [BAAQMD Regulation 2-1-234.1]



7. The duct burner (S-2) shall be fired exclusively on natural gas. [Cumulative Increase; Offsets]
8. Diesel fuel oil may be burned in the turbine (S-1) during:
  - a. periods of natural gas curtailment
  - b. periods of testing[Cumulative Increase; Offsets]
9. The sulfur content of the diesel fuel shall be no more than 0.5% by weight. [BAAQMD Regulation 9-1-304]
- 10a. The owner/operator shall burn no more than 670,000 gallons of diesel fuel in the turbine in any consecutive 12-month period, except as allowed by part 10b below. [Synthetic Minor Operating Limit]
- 10b. If the sulfur content of the fuel is shown to be less than 0.5% by weight by vendor certification, the owner/operator may burn additional diesel fuel in the turbine if the owner/operator can show that no more than 22.5 tons SO<sub>2</sub> are emitted from the turbine during any consecutive 12-month period. The SO<sub>2</sub> emissions from diesel firing shall be calculated on a monthly basis. To calculate the SO<sub>2</sub> emissions in this case, the owner/operator shall use the following assumptions and equation:
  - a. The weight of diesel fuel is 6.7 lb/gal
  - b. Two pounds of SO<sub>2</sub> are generated for each pound of sulfur in the fuel
  - c.  $(\text{gal diesel fuel}) \times (6.7 \text{ lb/gal diesel fuel}) \times (\text{weight \% S in fuel, lb/100}) \times (2 \text{ lb SO}_2/1 \text{ lb S}) = \text{SO}_2 \text{ emissions, lb}$
11. The total hours of operation, including emergency use, at S-3, Diesel Emergency Generator, shall not exceed 500 hours per any calendar year. [Synthetic Minor Operating Limit]
12. The owner operator shall measure CO and NO<sub>x</sub> concentration in units of ppm (vol) once per month from the combined stack of these sources using a handheld instrument. The owner/operator shall calibrate the instrument before each measurement in accordance with the manufacturer's instructions. [Synthetic Minor Operating Permit Condition]
13. The owner operator shall measure oxygen content of the stack emissions in units of percent once per month from the combined stack of these sources using a handheld instrument. The owner/operator shall calibrate the instrument before each measurement in accordance with the manufacturer's instructions. [Synthetic Minor Operating Permit Condition]

14. The owner/operator will estimate the monthly CO emissions from the combined stack of S-1 and S-2, using the following equation within 30 days of receipt of the natural gas invoice from the utility company:

$$\text{CO (lb/month)} = (\text{natural gas usage in MMbtu/month}) \times (8710 \text{ dscf/MMbtu}) \\ \times (21\% / (21\% - \text{oxygen in percent})) \times (\text{CO concentration in ppmv/E6}) \times (0.00259) \times \\ (28 \text{ lb CO/lb-mole CO})$$

Note: to convert therms to MMbtu, divide by 10. The constant "0.00259" incorporates the gas constant and standard gas conditions to convert volume to lb-moles CO.

[Synthetic Minor Operating Permit Condition]

15. The owner/operator shall estimate the annual CO emissions every month by summing the emissions estimates for the previous 12 months. [Synthetic Minor Operating Permit Condition]

16. The owner/operator will estimate the monthly NOx emissions (as NO<sub>2</sub>) from the combined stack of S-1 and S-2, using the following equation within 30 days of receipt of the natural gas invoice from the utility company:

$$\text{NOx (lb/month)} = (\text{natural gas usage in MMbtu/month}) \times (8710 \text{ dscf/MMbtu}) \\ \times (21\% / (21\% - \text{oxygen in percent})) \times (\text{NOx concentration in ppmv/E6}) \times (0.00259) \times \\ (46 \text{ lb NOx/lb-mole NOx})$$

Note: to convert therms to MMbtu, divide by 10. The constant "0.00259" incorporates the gas constant and standard gas conditions to convert volume to lb-moles NOx.

[Synthetic Minor Operating Permit Condition]

17. The owner/operator shall estimate the annual NOx emissions every month by summing the emissions estimates for the previous 12 months. [Synthetic Minor Operating Permit Condition]

18. To comply with the requirements of the above conditions, the owner/operator shall record the amount of natural gas burned, fuel oil burned, the percentage of oxygen, the NOx and CO measurements, the CO and the NOx calculations, and the hours of operation of the emergency generator in a District approved log on a monthly basis. The owner/operator shall keep the log on-site and make it available to District inspection for a period of at least 60 months from the date on which the owner/operator makes a record. [Synthetic Minor Operating Permit Condition]

19. The owner/operator shall report any non-compliance with the above conditions to the Director of Enforcement and Compliance within 10 days of discovery of non-compliance. [Synthetic Minor Operating Permit Condition]
20. The owner/operator shall submit the following report to the Director of Enforcement and Compliance every year by September 1<sup>st</sup>. The report shall contain:
  - a. The monthly measurements of NOx and CO concentration at the turbine and duct burner exhaust
  - b. The monthly measurement of oxygen concentration at the turbine and duct burner exhaust
  - c. The monthly natural gas usage in therms or thousand cubic feet
  - d. The monthly diesel fuel usage at the turbine in gallons
  - e. The monthly estimates of CO emissions from the turbine and duct burner in lb/mo
  - f. The monthly estimates of NOx emissions from the turbine and duct burner in lb/mo
  - g. The annual estimate of CO emissions from the turbine and duct burner in tons/12 consecutive months
  - h. The annual estimate of NOx emissions from the turbine and duct burner in tons/12 consecutive months
  - i. The annual hours of operation of the emergency generator

by \_\_\_\_\_ date \_\_\_\_\_  
Brenda Cabral  
Air Quality Engineer II